JP 2002-535954 10/22/2002

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
This invention belongs to the field of the rotating electric machine, and has a permanent magnet rotator, and is applied to the structural configuration of the high power motor or generator with which the special cure for drawing heat to the supporter of a stator to the coil edge of a stator winding is taken. Such a motor is used as a driving motor for marine vessels. As a generator, it is used for example, for a wind-force facility.
[0002]
The well-known synchronous motor of the above-mentioned format is arranged in car gondola-like housing at the hull bottom. By clamping a stator configuration association-wise or in force association in housing, cooling of the stator by surrounding seawater, therefore cooling of a stator winding are guaranteed. The blower or the additional cooling system of the gestalt of an atomiser may be attached to the coil edge of a stator winding (the [international disclosure] No. 97/49605 description). Furthermore, using the heat derivation bridge which consists of synthetic resin like epoxide resin to the coil edge of such a synchronous motor is already proposed, and this synthetic resin contains the mineral as a thermally conductive filler (the [international disclosure] No. 99/05023 description).
[0003]
Using the synchronous motor which has a permanent magnet rotator as an object for motors used since a control rod is driven within the pressure tank of a reactor vessel is known, and the heat bridge which consists of the porous mineral filler which fills coil edge space is prepared as a heat bridge (thermal short circuit way) to stator housing to the coil edge of a rotator (the European Patent application disclosure No. 0523353 description and the German patent application disclosure No. 69203988 description). .
[0004]
In case a permanent magnet synchronous motor is used for marine vessel actuation, and in case such a motor is arranged inside a hull, usually a stator winding is cooled by using the yoke ring in which the channel which has fresh water poured is established as a stator, i.e., a supporter for stator windings. The cooling fin arranged at the end of the yoke ring guarantees good cooling of a coil edge (Jahrbuch der schffbautechnischen Gesellschaft 81 (1987), the 221st / 222 pages). Establishing a cooling water way in the wall of housing which surrounds a stator also in the case of the motor used for the case of the permanent magnet synchronous motor for automobiles and various actuation objects is known (the German patent application disclosure No. 4213132, the France patent application disclosure No. 1571890).
[0005]
Furthermore, constituting an electric machine so that a rotator may surround a stator is also known. In the case of the need, in such an "outer rotor" form electric machine, the stator appears on the supporter of the shape of tubing in which the cooling water way may be established (other reference in German patent application announcement No. 1203373 description and IPC H02K 1/06).

[0006]
Furthermore, in order that a rotator may rotate the inside of the medium of high temperature and a stator may cool the coil edge of the electric machine closed with tubing with a slot to the rotator The heat conductor of the shape of a ring which consists of a copper casting between a coil edge and the housing cover cooled is arranged. Surrounding with the embedding ingredient which consists of the transcalency and an electric insulation ingredient like the insoluble silicon resin which has the filler which consists of the alumina of the shape of powder to which the coil edge was distributed finely, for example is also known (the German patent application announcement No. 1204316 description). Furthermore, an aluminum ring is attached to a stator winding edge for the object of heat derivation, and the electric machine with which the bridge of the gap between a coil edge and a ring is carried out by the thermally conductive filler layer (for example, epoxide resin) is also known (the Austria patent application disclosure No. 151584 description, U.S. Pat. No. 3508092 description). Furthermore, in order to sink in the stator winding of an electric machine, the epoxide resin which has the thermal conductivity of 0.26 cal/m-sec and ** by addition of a ceramic filler is used (the German patent application disclosure No. 3808190 description).
[0007]
The technical problem of this invention is leaving the rotating electrical machine (the German patent application disclosure No. 69203988 description) which has the configuration of the whereas clause of claim 1, and giving the highest possible thermal conductivity to a heat bridge.
[0008]
The metal solid-state ring with which according to this invention the heat bridge (thermal short circuit way) attached to the coil edge is constituted by the solid, and suits the outside profile of a coil edge in ******, respectively, and this technical problem is combined with the supporter of a stator in force association, It consists of the casting resin object which is cast in this solid-state ring and is embedding the coil edge and which has larger thermal conductivity than 1.6W[/m] degree K. A solid-state ring consists of ring plates of a large number by which the laminating was carried out in the direction of an axis, and it is solved when the casting resin object contains powder-like a transcalency filler or filler mixture in 50 - 90% of the weight of the amount.
[0009]
It is embedded to the thermal-conductivity casting resin inside of the body with which a bridge is carried out with the solid-state ring which consists of a metal like aluminum or copper by the method to which the space between the coil edge of a stator and a supporter suited the object mostly on the other hand in the embodiment of the heat bridge prepared by this invention, is fully close to the supporter of a stator, and has defined comparatively small spacing to a coil edge, and the coil edge is fully close to the solid-state ring on the other hand. When the air space which checks heat derivation does not exist radially between a coil edge and the supporter cooled, the optimal heat shift to the supporter cooled from the coil edge of a stator is guaranteed.
[0010]
Division of the solid-state ring to the plate of further each is performed. This division carries out the role which reduces eddy current loss. Such a plate enables detailed adaptation to the outside profile of a coil edge by carrying out the phase division of the bore of a plate finely simultaneously. Such arrangement and a configuration of a solid-state ring guarantee that leave the supporter by which a stator is cooled and comparatively slight temperature is drawn to near the nearby coil edge.
[0011]
To the casting resin object of a heat bridge, the casting resin system of the heat class F (continuation thermal resistance of 155 degrees C) which has a good temperature cycle property, a high mechanical strength, and a low coefficient of thermal expansion besides high thermal conductivity is used. Probably, the adhesion in the interface between a casting resin object and a solid-state ring must also be guaranteed in that case. The resin which uses polyester, ester imide, silicone, polyurethane, and epoxide as the base especially as casting resin deserves consideration. It has become clear that the resin which uses epoxide as the base, especially the resin in which acid-anhydride hardening is possible are suitable

especially based on the property profile which was able to take the balance. Besides bisphenol A and/or the epoxide resin of the aromatic series of Bisphenol F, the resin which has the following presentation especially deserves consideration. a) the aromatic series which had epoxide resin of aliphatic series mixed depending on the case, and/or different species -- in annular poly epoxide resin, the anhydride with which the acid ester which consists of an anhydride depending on the b case was mixed or anhydride mixture especially a carbon acid anhydride or carbon acid-anhydride mixture, c, for example, an accelerator like an amine accelerator, and that case, Components a and b are ratios 1:1 by the usual method at stoichiometric, or Component b is slight -- it is insufficient and is used.

[0012]

Since a mechanical property is affected, the casting resin object manufactured using such well-known resin marketed may be embedded, and it may contain **** and/or a flexible textile liner as a component. However, it is important that the bulking agent which carries out the operation whose casting resin which should be processed carries out the role which raises thermal conductivity, makes the expansion coefficient of a casting resin object low depending on the case, and raises thermal shock resistance is included. Especially suitable things are aluminum oxide, an aluminum nitride (aluminum nitride covered especially), silicon carbide, metal powder like an aluminium powder and quartz powder, and an inorganic bulking agent still like the mixture of these matter that has immanent high thermal conductivity. the bulking agent combination chosen, respectively -- the casting resin inside of the body -- a maximum of 50 % of the weight - 90 % of the weight -- probably, it should be preferably contained in 60 - 90% of the weight of the amount. If bulking agent combination contains quartz powder, this should exist in at most 10% of the weight of the amount.

[0013]

An aforementioned filler or filler combination is blended comparatively good in the aforementioned resin. It is because these resin has comparatively low viscosity. The resin which uses especially poly epoxide as the base has further 70-100 degrees C of about 60-90 degrees C of application also with the good basis of the pressure impression following the basis of ordinary pressure, a vacuous basis or a vacuum, and it in a detail preferably in the case with a temperature of 80-90 degrees C in the case with a processing temperature of 75-85 degrees C. The heat bridge constituted by this invention has larger thermal conductivity than 1.6W[/m] degree K within the limits of a casting resin object, and, in the case of a very high filler mixing rate, has even larger thermal conductivity than 2.0 W/mdegree K.

[0014]

The heat bridge constituted by this invention is mechanically stable, and the coil edge reinforcement usually used can be omitted. When the casting resin object is having the insulating filler added electrically, the main insulation of coil one end required in the case of suitable coil structure can also be omitted.

[0015]

In the case of the driving motor arranged the case of the marine vessel driving gear which should be arranged for example, in the shape of car gondola, or inside a hull, it comes out so, and especially the heat bridge constituted by this invention is applied to the rotating electrical machine whose supporter is a certain housing surrounding a stator like. However, the heat bridge of a new format may be used also for the rotating electrical machine with which the supporter is arranged inside the stator surrounded by the rotator. A possible applicable field is the generator of a wind-force facility in that case.

[0016]

The example of a new heat bridge is shown in drawing 2 . The example of the casting resin ingredient used to this heat bridge is explained later. The heat bridge shown in drawing 2 is used in the driving motor of drawing 1 .

[0017]

Based on an international disclosure/[97th] No. 49605 description, drawing 1 of this description shows the car gondola-like driving gear for marine vessels with which the synchronous motor which consists of a stator 7 and a rotator 10 in housing 1 is arranged. The stator 7 of a synchronous motor is inserted in in the cylindrical hollow housing part 2 in configuration association, and this housing part is preferably

burned, inserted in and carried out on the stator laminate. This housing part forms the supporter of the shape of tubing of a stator, for example, consists of a transcalency ingredient like a bronze alloy. The coil of a stator is known at the coil edges 8 and 9. The rotator 10 of a synchronous motor is constituted as a rotator excited with a permanent magnet, and is attached in the driving shaft 5 with the maintenance structure 11.

[0018]

According to drawing 2 , the heat bridge which consists of the solid-state ring 91 surrounding the coil edge of each time and the casting resin object 94 cast in it is attached to the coil edges 8 or 9 of both sides, respectively. This heat bridge fills thoroughly the medium space between the coil edges 8 or 9 and a supporter 2, and the coil edge is embedded in the casting resin object 94 in that case. the casting resin inside of the body -- the ring for the electrical installation of a stator winding -- a conductor 95 -- and it binds tight and a mounting element like a plate is also embedded.

[0019]

The ring plate 92 which the solid-state ring 91 consists of each thin plate of the gestalt of the ring plate divided into the segment, among those is arranged at the left part has an equal bore, and the ring plate 93 arranged along with the profile to which the coil edge 9 descends on the other hand has the bore which becomes small. Thereby, a solid-state ring suits the profile of the coil edge 9 so that about 5mm comparatively small gap may remain between the solid-state ring 91 and the coil edge 9. In case the solid-state ring 91 carries out the shrinkage fit of the tubing-like housing part 2 to a stator 7 by the end-face side with the mounting bolt 96 prolonged in the direction of an axis, it is attached in the stator 7 so that the shrinkage fit of this may be carried out also to the solid-state ring 91. A solid-state ring is motor made a required dimension (outer diameter) by the revolution chisel as well as a stator as preparation for that. In order to manufacture the solid-state ring 91, the block of the shape of the bell shape which carries out a role of an inside mold part of the casting resin object 94 inside a coil edge, or ** is arranged. Subsequently, the casting resin object 94 is in the condition which has arranged the stator vertically, and is manufactured by hardening of a suitable casting resin ingredient which pours in and follows it.

[0020]

The casting resin suitable for the application shown has the following presentation.

a) The aluminum nitride, quartz powder for e29 weight which were covered with the silicon dioxide for the epoxide resin for 92 weight, the carbon acid anhydride for b75 weight, the amine accelerator for c0.8 weight, and d550 weight.

[0021]

It is deaerated until it is mixed at the temperature which is 80 degrees C first and the aforementioned component results in a non-bubble condition at the same temperature continuously at the basis of the pressure of 1 - 10mbar, in order to manufacture a casting resin object. Then, at the temperature of 80 degrees C, casting of the casting resin ingredient is carried out, and it is hardened after that. Hardening is 80 degrees C, continues for 12 hours, it is 90 degrees C, and after that, is 100 degrees C and is continuously performed at 110 degrees C for 12 hours for 3 hours for 4 hours.

[0022]

Thus, the manufactured casting resin object has the thermal conductivity of 1.9 W/mdegree K.

[Brief Description of the Drawings]

[Drawing 1]

The outline sectional view showing the driving motor with which a heat bridge is used.

[Drawing 2]

The outline sectional view showing the example of the heat bridge by this invention.

[Description of Notations]

1 Housing 2 Hollow -- Cylindrical Housing Part 5 Driving Shaft 7 Stators 8 and 9 Coil Edge 10 Rotator 11 Maintenance Structure 91 Solid-state Rings 92 and 93 Ring Plate 94 Casting Resin Object 95 Ring -- Conductor 96 Mounting Bolt

[Translation done.]

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Have a permanent magnet rotator and the stator in which the coil is formed, and a tubing-like transcalency supporter is attached to a stator in force association. In the rotating electrical machine with which the heat bridge with which a supporter forms the heat bridge to a coolant and fills the medium space between a coil edge and a supporter thoroughly also at the coil edge of a stator winding is attached, respectively The metal solid-state ring with which the heat bridge attached to coil edge is constituted by the solid, suits the outside profile of a coil edge (9) in ******, respectively, and is combined with the supporter (2) of a stator in force association (91), It consists of the casting resin object (94) which is cast in this solid-state ring and is embedding the coil edge (9) and which has larger thermal conductivity than 1.6W[/m] degree K. The rotating electrical machine characterized by for a solid-state ring (91) consisting of ring plates (92 93) of a large number by which the laminating was carried out in the direction of an axis, and the casting resin object (94) containing powder-like a transcalency filler or filler mixture in 50 - 90% of the weight of the amount.
[Claim 2] The rotating electrical machine according to claim 1 characterized by consisting of the aluminum nitride with which the filler or the filler component was covered.
[Claim 3] The rotating electrical machine according to claim 1 with which a filler or a filler component is characterized by consisting of metal powder like an aluminium powder.
[Claim 4] The rotating electrical machine according to claim 1 characterized by the casting resin object (94) containing **** and/or a flexible cloth filler (95).
[Claim 5] Claim 2 characterized by the casting resin object (94) containing quartz powder in the amount to 10 % of the weight as another filler thru/or the rotating electrical machine of one publication of four.
[Claim 6] The rotating electrical machine according to claim 1 characterized by including the aromatic series and/or the different-species annular poly epoxide resin with which the casting resin object (94) had epoxide resin of aliphatic series mixed as resin depending on the following presentation and a case, the anhydride with which the acid ester which consists of an anhydride depending on the b case was mixed or anhydride mixture, and the epoxide resin which has c accelerator.
[Claim 7] The rotating electrical machine according to claim 1 characterized by being housing with which a supporter (2) contains a stator.
[Claim 8] The rotating electrical machine according to claim 7 characterized by being the part of the marine vessel propulsive engine which housing (2) should arrange in the shape of car gondola.
[Claim 9] The rotating electrical machine according to claim 1 characterized by what the supporter is arranged for inside the stator surrounded by the rotator (outside rotator machine).
[Claim 10] The rotating electrical machine according to claim 9 characterized by a rotator and a stator being the parts of an aerogenerator.

[Translation done.]

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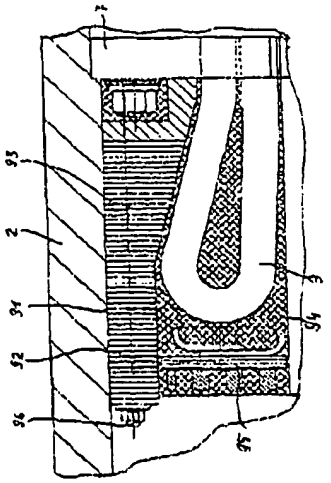
(54)【発明の名称】　永久磁石回転子を有する回転電気機械

(57)【要約】
永久磁石回転子を有する回転電気機械において、固定子の管状の熱良導性保持体が冷却材への熱ブリッジを形成する。固定子巻線の巻線端も有効に冷却し得るように、巻線端にも、巻線端と固定子保持体との間の中間空間を完全に満たす熱ブリッジが付設されている。この熱ブリッジは中実に構成され、固定子の保持体に力結合的に結合された固体リングと、この固体リング内に鋳込まれた注型樹脂体とから成っている。注型樹脂体は１．６Ｗ／ｍ°Ｋよりも大きい熱伝導率を有し、そのために粉末状の熱良導性充填材（好ましくはシリコン二酸化物により被覆されたアルミニウム窒化物）を５０～９０重量％の量で含んでいる。



【図１】

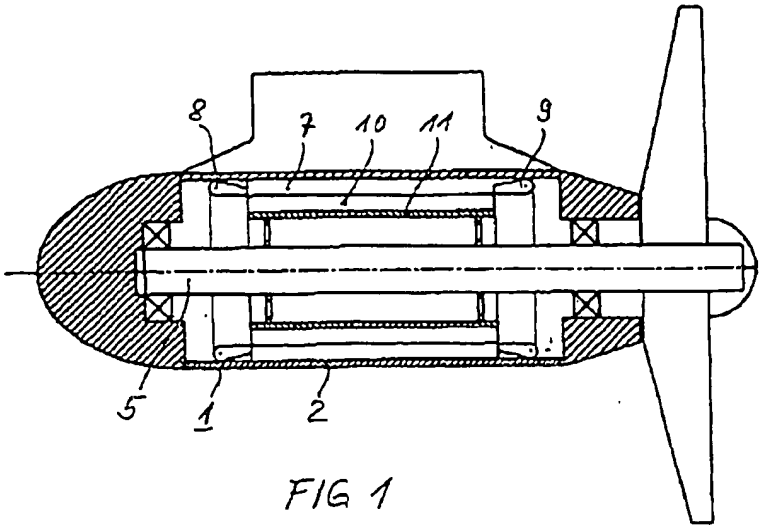


FIG 1

【図２】

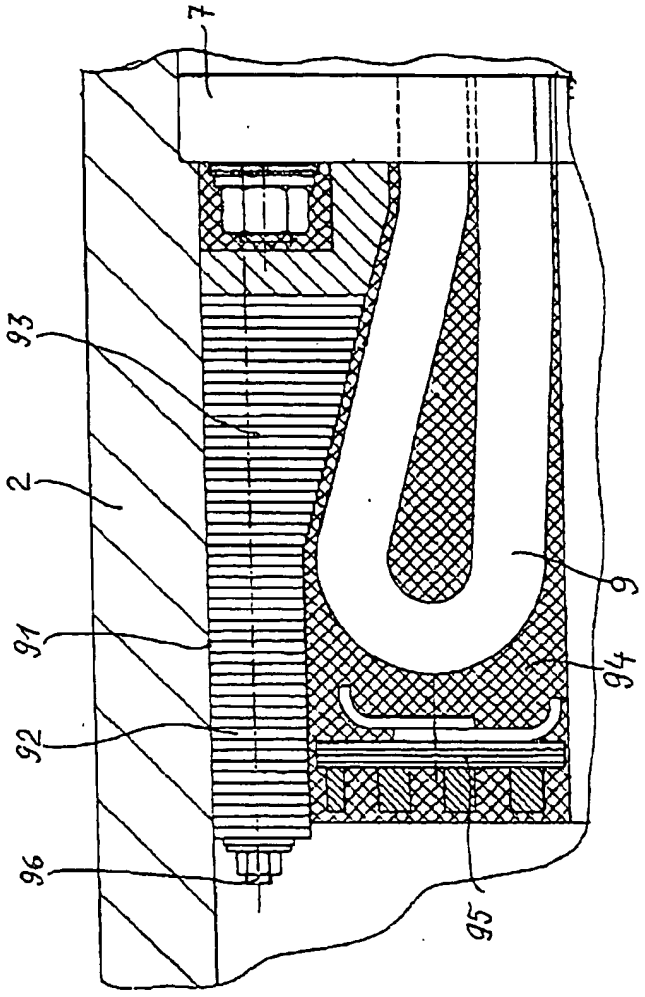


FIG 2